African Journal of Engineering Research
Vol. 3(2), pp. 37-43, July 2015
ISSN: 2354-2144
Full Length Research Paper

A study on the quality of sliver and noil using backward and forward feeding system of combing machine

M. Kalyana Kumar*, J. Redwan and Ermiyas Misgana

Department of Textile Engineering, Kombolcha Institute of Technology, Wollo University, Ethiopia.

Accepted 21 July, 2015

ABSTRACT

Combing is the key processes for the quality improvement of spinning cotton fiber by extracting short fibres less than half an inch in length. The type of feeding system with varying machine setting has effect on the quality and the production rate of comber. This paper deals with the study of transfer of good fibres into the noil and transfers of short fibres into the sliver. For these studies, medium staple cotton variety of Shankar 6 has been taken and processed with both feeding systems of comber by varying the settings of fed length, top comb and detaching roller. The quality distribution of feed lap, noil and combed sliver has been evaluated under Advanced Fibre Information System (AFIS). Better fibre control was observed with backward feeding as compared to forward feeding. The transfer of longest fibre into the noil is observed less by 12.5% and the length of shortest fibre into the comber sliver is also less observed by 4.7% by keeping constant top comb index with varying feed length and detaching distance of both feeding system when compare to other variables.

Keywords: Comber, backward feed, forward feed sliver, noil, AFIS.

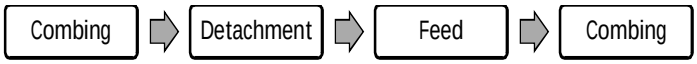
*Corresponding author. E-mail: m.kalyan@outlook.com.

INTRODUCTION

The combing process is carried out in order to improve the quality of the sliver coming out of the card. The process eliminates short fibres and remnant fragments of impurities present in the card or drawn sliver to give clean sliver, having more of a rectangular staple diagram, with the vast majority of the constituent fibres in a straightened and parallel state. Combing therefore, make possible the spinning of yarns of fine count with low irregularities and a cleaner appearance (Lawrence, 2003). Carded slivers are combined into comber lap in a single continuous process stage; further flat sheet of fiber which was obtained from comber lap is fed into the comber in an intermediate process (Figure 1). The wastage which is removed from the comber machine during processing is known as comber noil. Mainly it consists of short fibers and neps. The type of feed is decided on the basis of amount of noil% and then the feed/nip is selected as it affects the productivity (Subramanian and Gobi, 2004). The performance of a comber is influenced by both the production rate and the extent of waste extraction. Waste from combing generally varies from 12 to 25%. Higher noil % always improves the imperfections in the final yarn. But the strength and other quality parameters improve up to certain noil %, further increase in noil results in quality deterioration. To optimize the quality performance for a given production rate and the waste level the type of feeding in the combing processes is most important factor. In actual practice, the amount of noil% to be extracted at comber is decided on the basis of end use of the yarn and the marketable value (Rikipedia).

In general, there are two types of feed are followed in the spinning industries:

1. Backward feed: The material is fed during the return of the nippers. The operational sequence is:



2. Forward feed: The material is fed whilst the nipper is

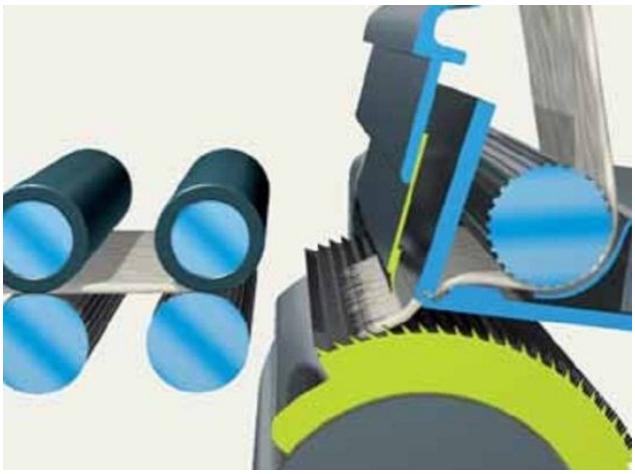


Figure 1. Intermediate process of combing action (Rikipedia).

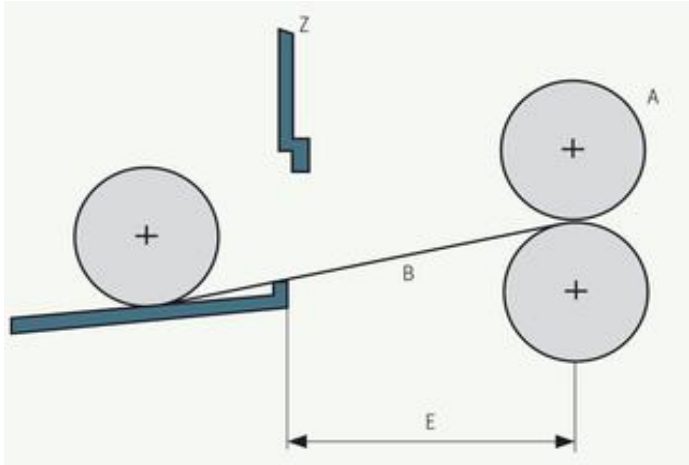
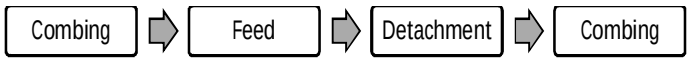


Figure 2. Position of the nippers relative to the detaching rollers at the closest approach (Detachment setting E) during backward feed (Rikipedia).

rocking towards the detaching roller. The operational sequence is:



Noil elimination with backward feed

During the detaching stage the nippers are located at their closest spacing relative to the detaching rollers (Figure 2), which draw off all fibers extending to the nip line, that is, all fibers longer than E. This length E can be entered in the staple diagram (Figure 3) as a line m-n. All fibers to the left of the line m-n pass into the combed sliver (hatched area AmnC).

The nippers retract towards the comb, the feed roller shifts the fiber fringe (initially with length E) forward through feed amount S. The fringe projecting from the nippers is now presented to the circular combs with length E + S (Figure 4). All fibers shorter than E + S are carried away by the circular combs because they are not clamped. They pass into the noil. In the staple diagram (Figure 3), this length can be entered as line q-r. In this stage all fibers to the right of the line q-r are combed out into the noil (area qBr). In the region qmnr, it is therefore a matter of chance whether the fibers remain in the fringe or pass into the noil. Accordingly, a division can be made based on the mean fiber length represented within this area, and it can be assumed that the trapezium AopC represents fibers transferred to the combed sliver and the triangle oBp represents those passing into the noil. The dividing line between these areas has length E + S/2. Since in similar triangles the areas are in the same ratio as the squares of the sides, and since the noil percentage is based on the ratio of weight of waste to weight of feedstock, the following relationship can be assumed (Rikipedia- Retier):

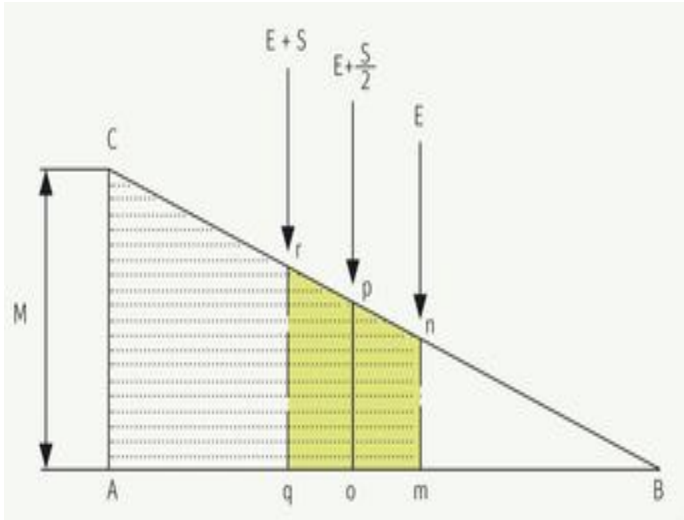


Figure 3. Combing out with backward feed.

$$p\% = \frac{oBp}{ABC} \times 100 = \frac{(op)^2}{(AC)^2} \times 100 = \frac{(E+\frac{S}{2})^2}{M^2} \times 100 \quad (1)$$

Noil extraction with forward feed

After the detaching stage has been completed, all fibers longer than E have been carried away with the web. Since there is no feed step during the return stroke of the nippers, the fringe is presented to the circular combs with length E. During the following combing cycle all fibers shorter than E pass into the noil; this is represented in the staple diagram (Figure 5) by the area qBr. Feed occurs during the subsequent forward stroke of the nippers, during which the fringe is increased in length by the

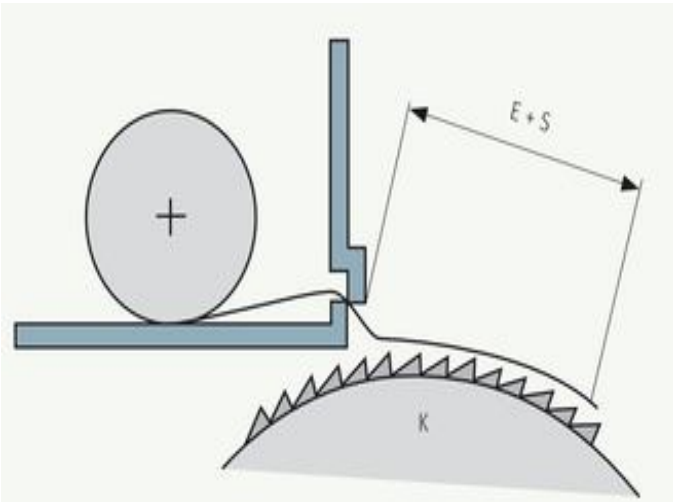


Figure 4. Combing out the fiber fringe (Rikipedia).

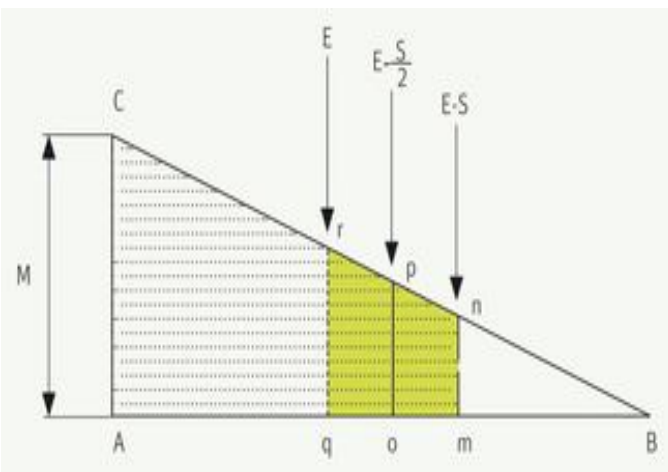


Figure 5. Combing out with forward feed (Rikipedia).

distance S. At the next stage, that of detaching, the detaching rollers take at least all fibers longer than E (Figure 6) into the combed web.

However, as feeding occurs at this stage, fibers b of the original length (E - S), that is, shorter than E by the feed amount, are now moved forward to the nip line by feed through distance S. That is why fibers longer than (E - S) are now carried away into the combed web, and trapezium AmnC represents these fibers.

In this case also, the figure qmnr can be divided according to the mean fiber length by the line op (E - S/2), and thus the following relationship can be derived as:

$$p\% = \frac{oBp}{ABC} \times 100 = \frac{(op)^2}{(AC)^2} \times 100 = \frac{(E - \frac{S}{2})^2}{M^2} \times 100 \quad (2)$$

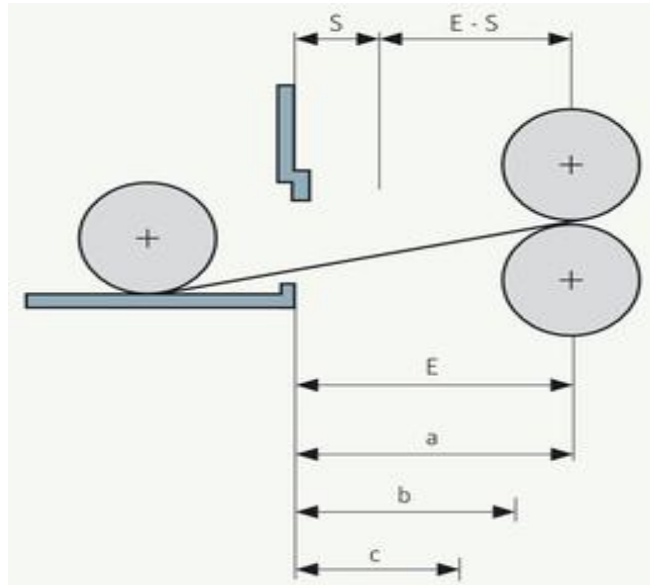


Figure 6. Position of the nippers relative to the detaching rollers at the closest approach during forward feed (Rikipedia).

Gupte and Patel (1986) reported that the % short fibre removal and % improvement in mean length are higher with forward feed as compared to that with backward feed at any level of noil. The increase in feed/nip increases the amount of fibre handled by the combing mechanisms and this reduces the combing efficiency and higher short fibre% (Subramanian and Gobi, 2004). For fibre of a particular length, whether it would go into noil or retain itself in the combed sliver is dependent on the modes of feed (Chattopadhyay, 2002).

In processing of forward feed the noil reduces, but in a backward feed it increases with the increased length of feed length per nip (Majumdar, 2012). Usually, a forward feed is selected for high production rates when quality demand is moderate, with the noil percentage kept between 5 and 14%. However, when a higher quality is necessary, a backward feed must be used, with a noil percentage in the range 14 to 25% (Klein, 1987). The cleanliness of the combed sliver is also dependent on the feed mode. Steady improvement in yarn quality can be achieved with an increase in comber waste to a point where most fibres below 15 mm length are removed (Garde and Subramanian, 1978). The backward feed always produces better sliver cleanliness than the forward feed (Klein, 1987). This can be ascribed to the increased combing of fibre before they seized by the detaching roller. Essential features in which the two feeds difference with respect to the quality of the combing sliver are not discussed yet by varying machine settings. The present paper reveals the type of comber feed and the critical influence on noil and sliver quality are indicated.

Table 1. Details of process parameter used in combing machine.

Particulars	Backward feed	Forward feed
Trail no.1 (Feed length constant and other varied)		
Noil	16%	16%
Feed length	5.5	5.5
Top comb index	-0.5	+0.5
Detaching distance	8.0	8.5
Trail no. 2 (Top comb index constant and other varied)		
Noil	16%	16%
Feed length	5.0	5.5
Top comb index	+0.5	+0.5
Detaching distance	8.0	8.5
Trail no. 3 (Detaching distance constant and other varied)		
Noil	16%	16%
Feed length	5.5	5.0
Top comb index	+0.5	+0.5
Detaching distance	8.0	8.0

MATERIALS AND METHODS

The combing processes have been undertaken in the spinning mill at M/s. Maa garment, Mekelle, Ethiopia. Medium staple cotton variety of Shankar 6 was used to conduct this study under different machine setting inReiter E65. Three different trails (Table 1) have been taken to find the significance difference of the quality parameter of sliver and noil. The removal of noil percentage was set at 16% and the quality attributes of the noil and sliver were evaluated by Advanced Fibre Information System (AFIS PRO2). The data obtained from the trails were compared and the relationship among the two feed were studied based on the length distribution of fibres (shortest fibre length in the sliver and the longest fibre length in the noil).

RESULTS AND DISCUSSION

The quality attributes of lap, sliver and noil from different level of trails obtained from the combermachine are shown in Table 2.

Length of longest fibre in the noil

The longest fibre in the noil is estimated from the length distribution charts (Figure 7a). The value of upper quartile length has been taken for the discussions, because the values are always nearest to the 2.5% span length of fibre.The fibre length of upper quartile length in all the three trails exceeded 12.7 mm length. From each trails, it is observed that, in backward feeding the amount of good fibre loss in noil is less when compared to the forward feeding. The average from both the fed of each trail the longer fibre above 12.7 mm were less transferred as 12.5% when keeping top comb index constant with varying feed length and detaching distances (Figure 7b). The higher amount of 15.7% of good fibre were passed into the noil when keeping the feed length distance constant and varied setting with top comb index and detaching roller distances (Figure 7c).

With backward feed, top comb penetrates into the fibre fringe which is already combed by the comber needle, therefore combing action done by top comb will be better. Hence the efficiency of removal of short fibre is good. During the nipper movement towards the detaching roller after the combing process, the distance of the nipper at the foremost position to the detaching roller is less therefore losses of long fibres in the waste during detaching will be less as observed. Whereas in forward feed the detaching distance is more and also the fed of lap is taking place while the nipper rocking forward during the detachment at this place the control of fibre exits the point of hold during detachment results loss of long fibre in the noil.

Length of shortest fibre in the comber sliver

The weight of fibres decides the hank of sliver to produce. In general, the higher weight of fibres will always biased to the longest fibres and the same time the shortest fibres will have less in weight percentages. In order to estimate the shortest fibre in the sliver, the value of short fibre content by weight has been taken through the length distribution chart (Figure 8a). In all the trials, the SFC (W) of sliver is less observed in backward feed than forward feed. SFC (W) is almost less than 6% were

Table 2. Quality attributes of comber lap, noil and sliver.

Details	L(w) (mm)	UQL(w) (mm)	SFC(w) <12.7 (mm)	L(n) (mm)	SFC(n) <12.7 (mm)	5% L (n) (mm)
Trail No. 1						
Backward Feed -Lap	24.8	31.1	8.3	18.9	23.5	35.5
Backward Feed -Noil	11.7	14.4	61.9	8.6	80.3	18.3
Backward Feed -Sliver	25.2	31.4	4.3	20.3	11.4	35.9
Forward Feed -Lap	25.2	31.1	8.3	18.8	22.8	35.3
Forward Feed -Noil	11.5	14.3	64.3	8.1	83.0	18.0
Forward Feed -Sliver	25.6	31.3	5.5	19.9	14.1	35.7
Trail No. 2						
Backward Feed -Lap	25.3	31.0	8.2	19.1	23.8	35.2
Backward Feed -Noil	11.5	14.1	60.1	8.7	80.1	18.4
Backward Feed -Sliver	25.8	31.2	4.1	20.5	11.7	35.8
Forward Feed -Lap	24.4	29.8	8.1	18.5	22.5	34.3
Forward Feed -Noil	11.3	14.5	64.3	7.9	82.0	18.2
Forward Feed -Sliver	24.8	31.1	5.2	19.3	14.8	34.6
Trail No. 3						
Backward Feed -Lap	25.2	31.1	8.0	18.7	23.2	35.3
Backward Feed -Noil	12.5	13.9	63.2	8.5	82.2	18.1
Backward Feed -Sliver	25.5	31.3	4.6	20.1	11.5	35.7
Forward Feed -Lap	24.8	31.1	8.5	18.1	22.2	34.6
Forward Feed -Noil	10.9	15.5	63.3	8.2	81.6	17.8
Forward Feed -Sliver	25.0	29.1	5.5	19.0	13.2	34.8

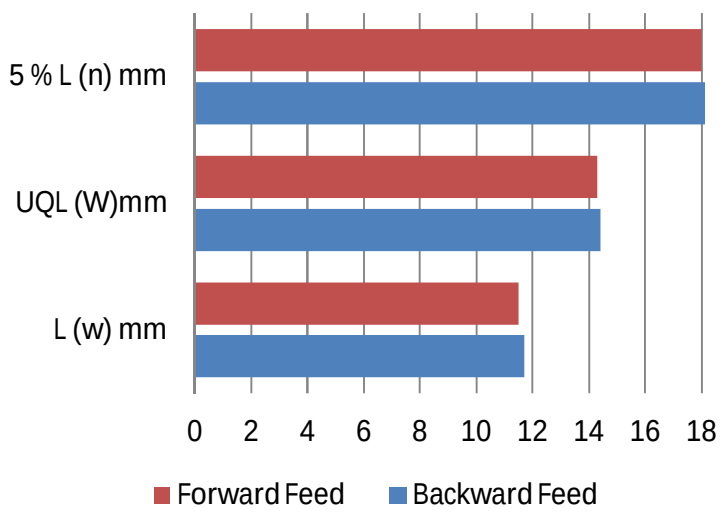


Figure 7a. Noil length distribution of trail no. 1.

observed in both the fed.

Taking average value of both fed in each trails, it was noticed that 4.7% of short fibre content by weight present in combed sliver when keeping the top comb index constant and varying feed length distance and detaching roller distances (Figure 8b). The highest value of 5.5% SFC (W) were noticed in the combed sliver when the detaching roller distance is kept constant and varying with top comb index and feed length distance (Figure 8c). Backward feed will always have tends to control the fibres within the action of detaching distance and penetration of top comb index. All the short fibres have

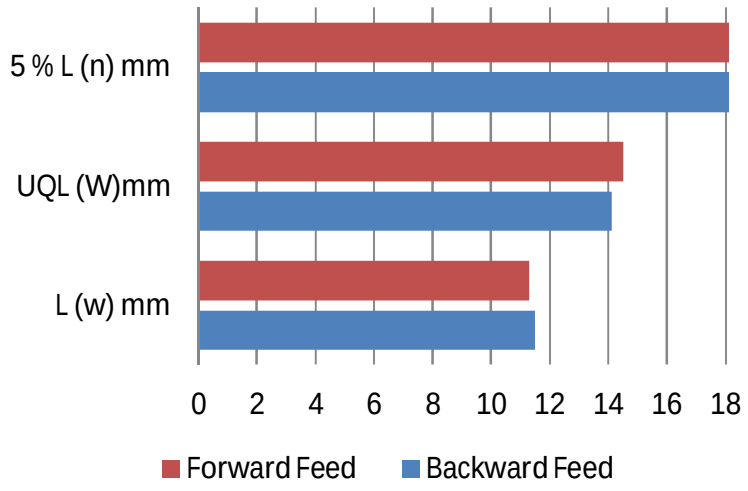


Figure7b. Noil length distribution of trail no. 2.

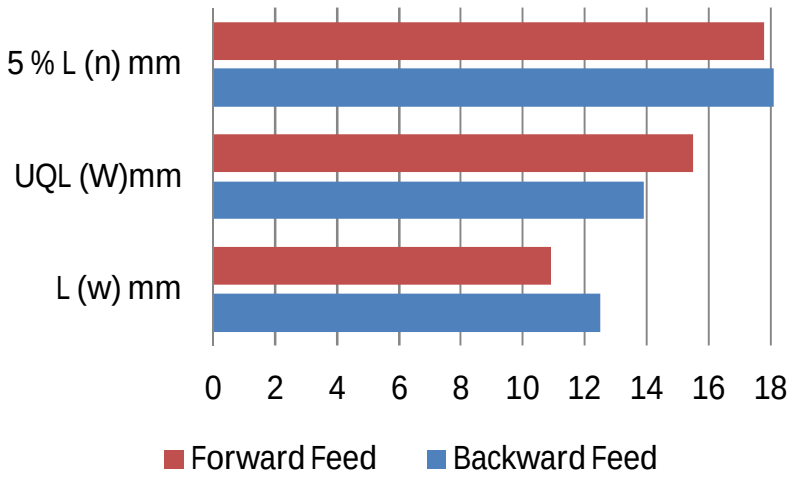


Figure 7c. Fibre length distributions of trail no. 3.

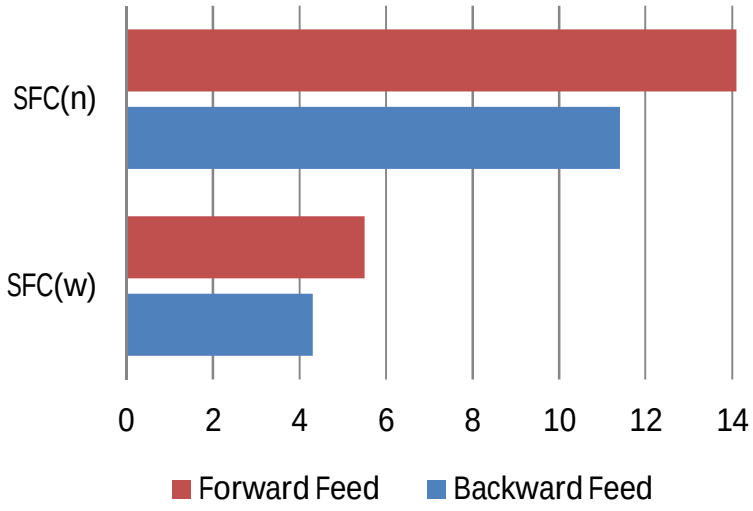


Figure 8a. SFC length distribution of sliver - Trail no. 1.

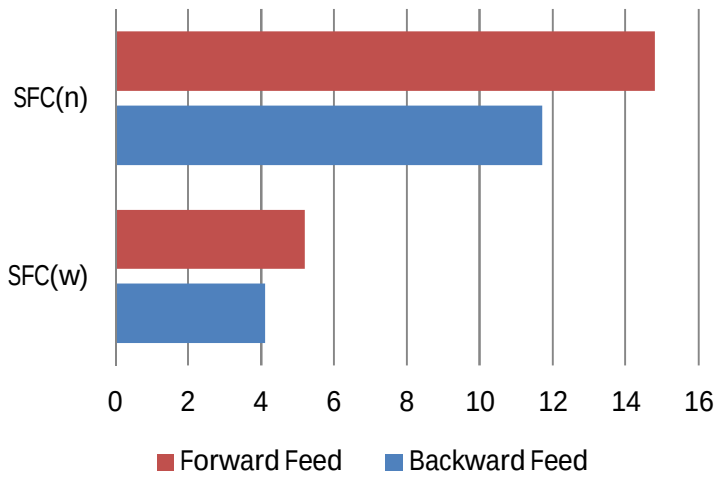


Figure 8b. SFC length distribution of sliver - Trail no. 2.

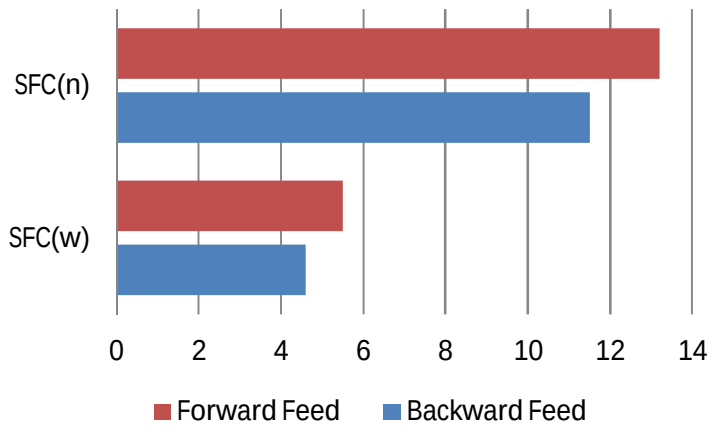


Figure 8c. SFC length distribution of sliver - Trail no. 3.

been taken away from the unicomb with the course of actions. Hence, the percentage of short fibre transferred into the sliver is minimum when compare to the forward feed of combing.

Conclusion

By eliminating the short fibres, overall all mean length was improved in the combed sliver. It is achieved by controlling the fiber in the process to decide the quality of combed sliver by adjusting the machine setting variables. When top comb was kept constant and feed length and detaching distances of both fed was varied, the length of shortest fibre in the comber sliver was observed less by 4.7%. Similarly, the length of longest fibre in the noil was observed very less by 12.5%. When detaching distance was kept constant with varying feed length and top comb index in both the feeding type, the quality of combed sliver is highly affected.

REFERENCES

Chattopadhyay R, **2002**. Advances in Technology of Yarn Production. New Delhi: NCUTE Publications.

Garde AR, **Subramanian** TA, **1978**. Process Control in Cotton Spinning, 2nd Ed. ATIRA: Ahmedabad.

Gupte A, **Patel** BA, **1986**. 27th Joint Technological Conference of ATIRA, BTRA, SITRA & NITRA (NITRA, Ghaziabad).

Klein W, **1987**. Short Staple Spinning Series. A practical Guide to Combing and Drawing. Vol 3, (Manchester, The Textile institute).

Lawrence CA, **2003**. Fundamentals of Spun Yarn Technology, CRC Press LLC, pp.-238.

Majumdar A, Das A, Alagirusamy R, Kothari VK, **2012**. Process Control in Textile Manufacturing, Woodhead Publishing.

RIKIPEDIA, The noil extraction theory- www.reiter.com.

Subramanian S, **Gobi** N, **2004**. Effect of process parameters at comber on yarn and fabric properties. Indian J Fibre Textile Res, 29:196-199.

Citation: Kumar MK, Redwan J, Misgana E, 2015. A study on the quality of sliver and noil using backward and forward feeding system of combing machine. Afr J Eng Res, 3(2): 37-43.